Distal port incision with antegrade tunnel technique is equal to proximal port incision with retrograde tunnel technique in rates of procedure related infections

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Aims and objectives

Introduction

Numerous medical conditions such as advanced stages of cancer require continuous venous access. Chronic central venous access devices have evolved over the years from simple central vein catheters to tunneled central catheters to ultimately fully implanted central venous ports increasing patient comfort and reducing the chance of device-related infections. Port placement in the interventional radiology suite has demonstrated equivalent safety and efficacy with similar complication rates to the operating room by multiple investigators. Long term durability of venous access ports is also well established.

Over the years, varying methods for venous access port placement have been described that all involve three major steps: (1) establishment of a venous access, (2) the creation of a subcutaneous tunnel and (3) the creation of a subcutaneous port pocket. Classical surgical approach utilizes single incision and venous access with port placed caudal to the incision site. The insertion method most widely used by interventional radiologists is a two incision technique based on a proximal port incision and retrograde tunneling technique (so called proximal port incision with retrograde tunneling technique (PPRT)). In addition, a single incision, single puncture method has been described which also places the port pocket caudally to the incision site. So far, only one study has described jugular access utilizing a two incision method with an upwardly created pocket and antegrade tunneling and reported technical benefits for port implantation and port removal. Extending on these findings, we present here a similar technique demonstrating a distal port incision and upward port pocket creation with antegrade tunneling (DPAT). The purpose of this retrospective study was to compare the proximal port incision with retrograde tunnel technique (PPRT) with our approach of a distal port incision with antegrade tunnel technique (DPAT) regarding the rates of procedure related infections.
Methods and materials

Subjects

We retrospectively studied 566 patients who underwent venous access device placements at two community based hospitals in Canton, Ohio from 2010-2012. In detail, 290 subjects were studied for the DPAT method (177 females, 113 males) and 276 patients (176 females, 100 males) for the PPRT method. All patients were followed-up for 30 days by telephone either to the referring physician's office or directly to the patients and tracked for procedure related infections. Procedure related infections were defined as surgical site infection (erythema, purulent drainage, heat and pain), catheter related infection (catheter tip colonization of microorganisms) and sepsis none of which could be explained by comorbid underlying infection. Informed consent was obtained from all patients prior to the procedures. The study was approved by the local Internal Review Boards.

Port placement:

Attending interventional radiologists placed the devices with ultrasonographic (US) and fluoroscopic guidance. Prior to the port placement, all patients received conscious sedation by the supervising physician. The following two procedures were carried out as outlined below:

Proximal port incision technique with retrograde tunnel (PPRT) Fig. 1 on page

Before PPRT, the skin at the operation site was prepared using three cycles of 2% w/v chlorhexidine gluconate and 70% v/v isopropyl alcohol (ChloraPrep) separated by 2 minute increments. The patient was then draped in the usual fashion. After local infiltrative anesthesia with 2% plain lidocaine, the internal jugular vein was accessed utilizing a 4 French microaccess kit (Medcomp, Harleysville, Pennsylvania, USA) initially accessed by a 21 gauge microaccess needle under direct ultrasound visualization. Stable position within the vein was maintained with the 4 French upsizing dilator deployed over a .018 inch diameter microwire. A site on the upper anterior chest was then chosen for port pocket creation. After local infiltrative anesthesia with 2% lidocaine with epinephrine, a short incision was made and the subcutaneous pocket created within the subcutaneous fat using a 6 inch hemostatic forcep. The pocket was irrigated with bacitracin 12,500 units in 250cc normal saline premixed by pharmacy and dried with gauze. The peripheral end of a single lumen catheter from a plastic Dignity low profile CT port with attachable catheter (Medcomp, Harleysville, Pennsylvania) was then tunneled in
either a forward or backward fashion from the venipuncture site to the pocket. Using a guidewire and catheter exchange technique, the subcutaneous tissues were dilated and the delivery sheath for the port catheter deployed into the jugular vein under fluoroscopic control. The catheter was advanced through this and the peel-away sheath removed. The central end of the catheter was positioned at the cavoatrial junction under fluoroscopy and the trailing end trimmed and attached to the port. The port was placed in the pocket and secured with 2-0 nylon suture. The port was tested to demonstrate appropriate functionality, and primed with heparinized solution. The internal jugular dermatotomy was closed with 4-0 polyglactin 910 suture (Ethicon, Somerville, New Jersey, USA). The port pocket was closed in two layers with 2-0 and 4-0 polyglactin 910 suture (Ethicon, Somerville, New Jersey, USA).

Distal port incision antegrade tunnel technique (DPAT)

Standard sterile technique utilized for the DPAT method was a 3 step process and each agent was given 5 minutes of contact time. The first application was 2% w/v chlorhexidine gluconate and 70% v/v isopropyl alcohol (ChloraPrep). Then 0.7% iodine povacrylex and 74% isopropyl alcohol (Duraprep) was applied. And finally, povidone-iodine 10% (Betadine) was applied. The patient was then draped in the usual fashion Fig. 2 on page 6. After local infiltrative anesthesia with 2% plain lidocaine, a 21-guage microaccess needle (Cook Incorporated, Bloomington, Indiana) was advanced into the internal jugular vein under direct ultrasound visualization. Stable position within the vein was maintained with the.018 inch diameter microwire (Cook Incorporated, Bloomington, Indiana, USA). After additional local infiltrative anesthesia with 2% plain lidocaine, an approximate 3 cm incision was made at the inferior aspect of the anterior second rib edge. Using a combination of blunt and sharp dissection, the subcutaneous pocket was fashioned at the level of the superficial pectoralis fascia oriented towards the neck. Bard Power Port with unattached catheter (Bard, Salt Lake City, Utah, USA) was then assembled by pre-attaching the port catheter Fig. 3 on page 7. The port catheter was then tunneled from the cranial aspect of the pocket to the internal jugular dermatotomy in an antegrade fashion Fig. 4 on page 8. The port was drawn into position within the pocket and secured in position with 2-0 silk suture (Ethicon, Somerville, New Jersey, USA) Fig. 5 on page 9. Using a guidewire and catheter exchange technique, the subcutaneous tissues were dilated and the delivery sheath for the port catheter deployed into the jugular vein under fluoroscopic control. The catheter was sized by trimming the leading end of the catheter and deployed through the delivery sheath and delivery sheath removed in the standard fashion. The port tip rests at the cavoatrial junction. The port was tested to demonstrate appropriate functionality, and primed with heparinized solution. The port pocket was closed in two layers with 3-0 and 4-0 polyglactin 910 suture (Ethicon, Somerville, New Jersey, USA) Fig. 7 on page 11.
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Statistical analysis:

Normal distribution of age was assessed by visualization via histograms and Shapiro-Wilk-test. Inter-group differences in age were performed using independent t-tests.

Pearson’s chi-squared test was used to compare differences in gender composition and differences in infection rates between the two port placement techniques.
Fig. 1: A. Pocket planning. B. Pocket creation. C. Pocket irrigation. D. Hub/catheter underneath the incision.

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**Fig. 2:** Incision planning.

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Fig. 3: A. Catheter and reservoir. B. Pre-attached catheter to reservoir.

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Fig. 4: A. Black arrow indicating the superficial pectoralis fascia. B. Secure 2-0 silk suture placement. C and D Antegrade tunneling.

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Fig. 5: Deployment of port into the pocket.

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Fig. 6: A-D Sizing the catheter.

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Fig. 7: A-D Deep pocket closure. The arrow indicates final closure of the deep pocket.

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**Fig. 8:** A-B Final skin closure.

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Results

Both, the DPAT and PPRT groups demonstrated similar mean age (p = 0.6; DPAT: mean age females 59.8 ± 13.1 years; males: 62 ± 13.4 years; PPRT: mean age females 63.1 ± 12.5 years; males: 67.8 ± 11.9 years) and gender composition (DPAT: 61.0 % women, 39.0 % men: PPRT: 63.7% women, 36.6 % men, p=0.9 and p=0.4). Infection rates did not statistically differ between the two port insertion techniques and were generally very low (0% DPAT versus 0.7% PPRT; p=0.15). Of note, while no reported cases of procedure related infection presented within the 30 day follow up window in the DPAT group, a single infection at 38 days was identified. In the PPRT cohort, 2 out of 276 patients developed a procedure related infection within the 30 day window.
Conclusion

Our results indicate that distal port incision with antegrade tunnel technique and proximal port incision with retrograde tunnel technique are both safe procedures with similarly low infection rates. Concerning incision infection the DPAT method may demonstrate a theoretical benefit as the skin suture line is isolated from the port by a closed tissue plane. Additionally, the distal location of the incision is not close to the port itself thus theoretically maintaining usability of the port should an incision infection occur. Incision infection remains problematic with the PPRT method as the incision directly crosses the port hub and catheter.
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